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Research Paper

Antimicrobial efficacy of silver nanoparticles biosynthesized using *Caralluma fimbriata* extract

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ABSTRACT

The current study synthesizes silver nanoparticles using an aqueous extract from *Caralluma fimbriata*. The plant extract was used as a stabilizing and reducing agent to produce silver nanoparticles from silver nitrate solution. The creation of silver nanoparticles was detected using UV-visible spectrophotometry, FTIR and SEM. By detecting a characteristic surface Plasmon resonance peak, UV-visible analysis verified the formation of silver nanoparticles. As silver nanoparticles have antibacterial property, the generated silver nanoparticles were evaluated for antibacterial activity using the agar well diffusion method. The results showed that silver nanoparticles have potent antibacterial activity. The results of the study indicate that the production of silver nanoparticles by *Caralluma fimbriata* is a simple, safe, and effective process with potential applications in medicine.

INTRODUCTION

Given the revolutionary advancements in the industry, nanotechnology has become increasingly important in recent years [1]. Silver nanoparticles can be created using a variety of methods, including ball milling, electric arc discharge, chemical reduction, microemulsion, using polymers and polysaccharides, and green synthesis [2]. The majority of silver nanoparticles are made

because they have special electrical and biological qualities, are harmless, and have antimicrobial qualities [3]. The majority of silver nanoparticles are made because they have special electrical and biological qualities, are harmless, and have antimicrobial qualities [4]. Silver nanoparticles' intrinsic characteristics are mostly dictated by their coating, size, shape, size distribution, and surface chemistry [5]. *Caralluma adscendens* var *fimbriata* (Wall), sometimes referred to as *Caralluma*

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fimbriata Plowes, is a member of the Apocynaceae family. According to Healthline and the National Institutes of Health, it is customarily eaten as a snack, boiled, or picked to increase endurance. The bioactive components of the plant include alkaloids, tannins, flavonoids, saponins, and pregnant glycosides [6].

MATERIALS AND METHODS

Plant Collection

Local Parner, Ahilyanagar District, was the source of the *Caralluma fimbriata* plant material. The full *Caralluma fimbriata* plant was dried in the shade and ground into a coarse powder.

Authentication

Prof. S. R. Rahangdale of Annasaheb Waghare College in Otur, Tal. Junnar, Dist. Pune, authenticate the plant specimen.

Extraction Method

To make the decoction of *Caralluma fimbriata*, coarse plant material was boiled in water for three

hours. The filtrate was used for additional investigation once the mixture was filtered [7].

Silver Nanoparticle Production Method

Chemicals: Distilled water and silver nitrate.

Instruments: FTIR, SEM, UV Spectrophotometer, and magnetic stirrer.

Method: A 0.1 M silver nitrate solution was made by dissolving 1.7 grams of silver nitrate (AgNO_3) in 100 milliliters of distilled water. The mixture was stirred until it totally dissolved in order to obtain a transparent solution. A magnetic stirrer was used to continuously swirl a mixture of 50 milliliters of silver nitrate solution and 10 milliliters of plant extract at 470 revolutions per minute and between 45 and 60 degrees Celsius for four to five hours in order to produce silver nanoparticles. As silver nanoparticles formed throughout the reaction, the color of the fluid gradually turned brown. Once the reaction was complete and allowed to cool, the nanoparticles were utilized for further characterization studies [8].



Fig no.-1 Magnetic Stirrer

Evaluation Parameters

(1) UV-Visible Spectroscopy

The generation of silver nanoparticles was verified by UV-visible spectroscopic examination at Annasaheb Waghare College in Otur using a UV-visible spectrophotometer.

(2) Fourier Transform Infrared (FTIR)

FTIR analysis was performed on silver nanoparticles at the Central Instrumentation Facility of Savitribai Phule Pune University in Pune.

(3) Scanning Electron Microscopy (SEM)



At the Central Instrumentation Facility of Savitribai Phule Pune University in Pune, the generated silver nanoparticles were examined using SEM.

Anti-microbial Activity

The nanoparticles were subjected to agar well diffusion assay to evaluate the antimicrobial activity of it against E-Coli. The positive control used was ciprofloxacin. The plates were then incubated at 37°C for a whole day in order to assess the antimicrobial activity [9].



Fig no.-2 Silver Nanoparticles

(1) Evaluation of Silver Nanoparticles

i. UV-Spectroscopy

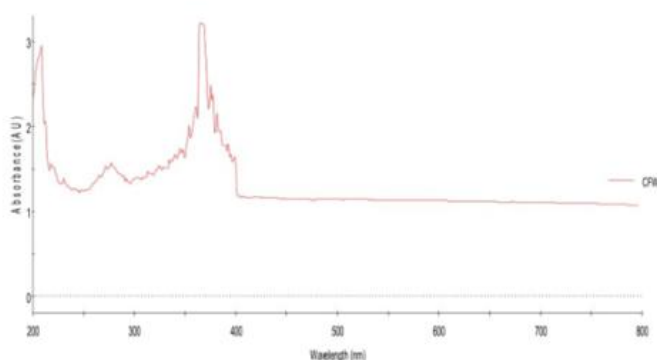


Fig no.-3 UV-Spectroscopy graph

In the UV-visible spectrum, a distinctive surface plasmon resonance peak in the 400–450 nm regions appeared, confirming the production of silver nanoparticles.

ii. FTIR

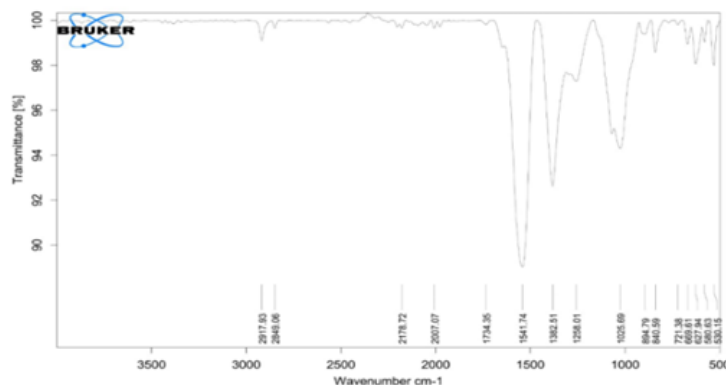


Fig no.-4 FTIR graph

The formation of silver nanoparticles is confirmed by the appearance of distinctive peaks in the 600–500 cm⁻¹ region of the FTIR spectrum.

iii. SEM

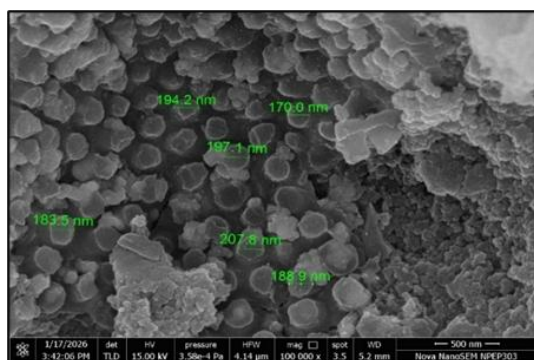


Fig no.- 5(A) SEM result

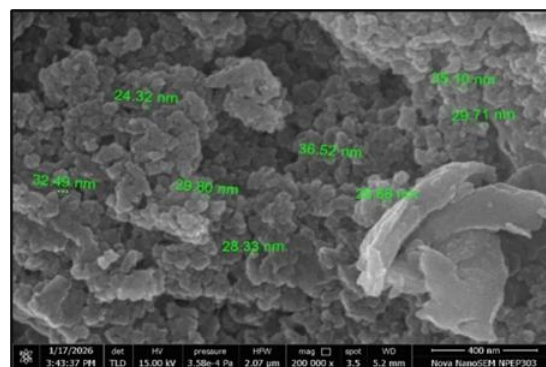


Fig no.- 5(B) SEM result

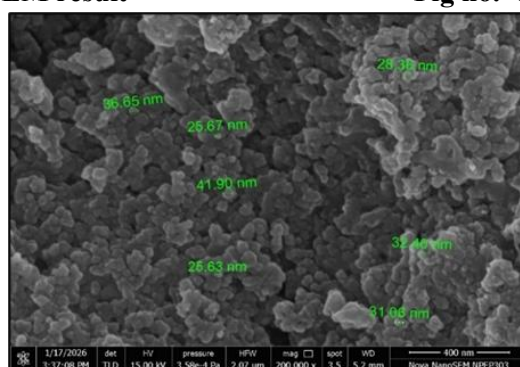


Fig no.- 5(C) SEM result

According to SEM analysis, the synthesized nanoparticles had a noticeable agglomeration and ranged in shape from irregular to nearly spherical. The particles were well distributed over the surface, confirming the successful formation of

silver nanoparticles. The SEM micrographs clearly demonstrated the nanoscale morphology of the synthesized particles.

Antimicrobial Activity

Table No. 1 Dose of Drug

Sample	B. E. Coli
	Zone Of Inhibition
Standard (40mg/ml)	4.2 mm
AgNO ₃ (10mg/ml)	2.6mm
AgNO ₃ (20mg/ml)	4.6mm
AgNO ₃ (40mg/ml)	8.7 mm

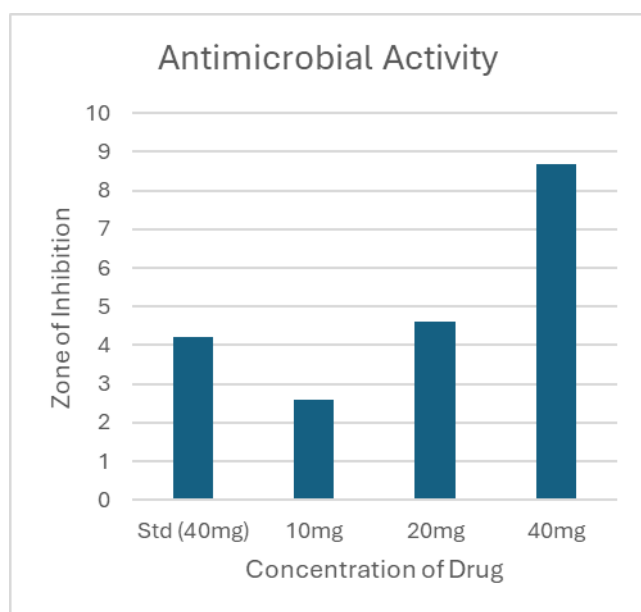


Fig no.- 5 Zone of Inhibition Graph

CONCLUSION

The research effectively produced silver nanoparticles utilizing *Caralluma fimbriata* extract through a straightforward and environmentally friendly approach. The presence of nanoparticles was verified through UV, FTIR, and SEM analyses. The nanoparticles demonstrated enhanced effectiveness at doses of 20 mg/ml and 40 mg/ml when compared to the standard medication.

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